Center Innovation Fund: JSC CIF

Multi-Phase Methane Heat Transfer Testing/Modeling for Regenerative Cooling

Completed Technology Project (2011 - 2013)

Project Introduction

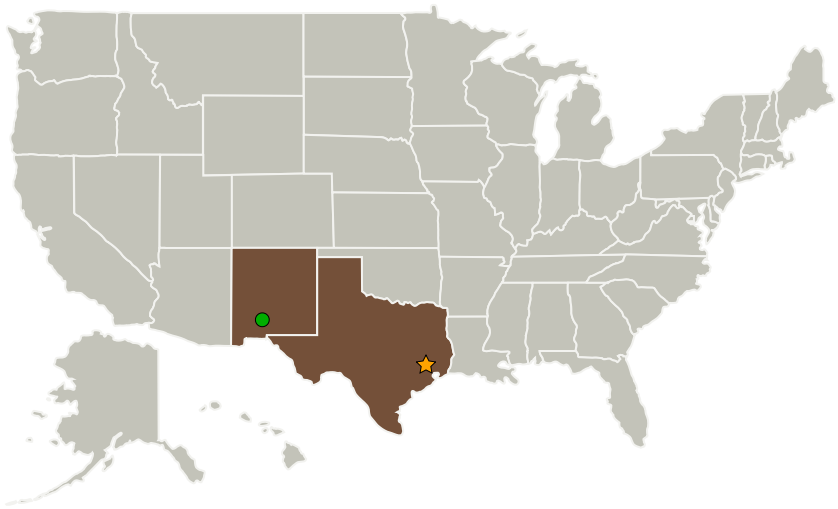
This proposal is to conduct a laboratory scale study of regeneratively cooled rocket engine heat transfer using methane. Measurements will include fluid and wall temperatures through multiple states and phase changes. Modeling work will produce a regeneratively-cooled engine analytical tool generated and validated with data. An innovative approach to testing and modeling is required for sub-critical methane boiling fundamental fluid physics.

This proposal will complete testing of existing straight channel test articles with enhanced instrumentation. Analytical work will focus on upgrades to the in-house modeling tool Regeneratively-Cooled Combustor Equilibrium Tool (RCCET-M) to allow modeling of 2-D heat transfer and dynamic boiling instability.

Anticipated Benefits

Regeneratively-cooled engines allow maximum specific impulse performance improvement for LOX/liquid methane cryogenic propulsion systems. Regenerative cooling reduces engine weight and improves performance by actively cooling the chamber walls with a closed-loop propellant. Design of sub-critical methane regeneratively-cooled engines requires new design tools validated with heat transfer data. Regeneratively-cooled main engine technology will be used on the Human Exploration and Operations Mission Directorate (HEOMD) Advanced Exploration Systems (AES) Project Morpheus vertical test bed, enabling lunar Iander ISRU tech demo missions.

Primary U.S. Work Locations and Key Partners



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Organizations Performing Work	Role	Type	Location
Johnson Space Center(JSC)	Lead Organization	NASA Center	Houston, Texas
White Sands Test Facility(WSTF)	Supporting Organization	NASA Facility	Las Cruces, New Mexico

Primary U.S. Work Locations	
New Mexico	Texas

Links

NTR 1
(no url provided)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Center / Facility:
Johnson Space Center (JSC)

Responsible Program:
Center Innovation Fund: JSC CIF

Project Management

Program Director:
Michael R Lapointe

Program Manager:
Carlos H Westhelle

Project Manager:
John C Melcher

Principal Investigator:
John C Melcher

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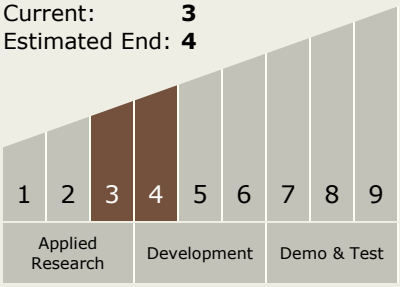
Completed Technology Project (2011 - 2013)

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **4**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.1 Chemical Space Propulsion
    - TX01.1.3 Cryogenic